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Sources of momentum profits in international stock markets

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Abstract

This paper examines the sources of momentum profits of countries exhibiting and not exhibiting momentum and compares the differences in the underlying factors determining momentum profits between these two groups of countries. We find remarkable differences in the decomposed components between these two groups of countries. Countries exhibiting momentum show that the cross-sectional dispersion in unconditional mean returns dominates the negative contribution from the component reflecting the intertemporal behaviour of asset returns. However, this is not the case in countries exhibiting no momentum. Furthermore, countries with greater relative contribution from the cross-sectional variance in unconditional mean returns tend to have greater momentum profits. Our results may support risk-based explanations for the momentum phenomenon rather than behavioural finance-based explanations.

Key words: Cross-sectional dispersion in expected returns; Decomposition of momentum profits; Intertemporal stock returns; Price momentum

JEL classification: G12, G14

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1. Introduction

If stock markets are efficient, investment strategies based on past information on stock prices should not produce abnormal returns. However, many papers have documented that such strategies generate abnormal returns. Jegadeesh and Titman (1993) document that firms with higher past returns persistently outperform firms with lower past returns over the midterm period

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(3–12 months). That is, past winners continue to be winners, and past losers continue to be losers. This violates market efficiency, since investors can earn persistently abnormal returns with zero investment by selling short past losers and buying long past winners.[1]

This momentum phenomenon has been found across countries and over time. Rouwenhorst (1998) and Griffin *et al*. (2003) report that this momentum phenomenon is also found in many countries outside the USA. Jegadeesh and Titman (2001) confirm their original results using the period subsequent to that covered in their original work and argue that their original results were not a product of data snooping bias.[2] Moskowitz and Grinblatt (1999) and Lewellen (2002) report that momentum strategies using equity portfolios generate even stronger profits. The most notable recent attempt to explain momentum profits using explicit risk factor models is Fama and French (1996). However, these authors report that although their three-factor model succeeds in explaining many notable regularities in stock returns that the Sharpe (1964) and Linter (1965) CAPM fail to explain, their three-factor model does not explain satisfactorily the momentum phenomenon.

Griffin *et al*. (2003) examine most intensively the phenomenon of momentum in international stock markets using a sample of 40 countries across four continents.[3] These authors report that the momentum phenomenon is not found in all countries. Most sample countries of Europe, North America and Africa exhibit the momentum phenomenon, while most Asian sample countries exhibit no such momentum phenomenon. Griffin *et al*. (2010) also show a significant differential in the momentum phenomenon across developed and emerging countries. These authors report that the momentum trading strategy earns much higher returns in developed countries than in emerging markets

[1] Some researchers are sceptical of the momentum phenomenon. For example, Lesmond *et al*. (2004) report that execution of momentum strategies (buying past strong performers and selling past weak performers) requires frequent trading in disproportionately high cost securities such that trading costs prevent profitable strategy execution. These authors conclude that the delay in price adjustment for security returns simply reflects the costs of arbitrage—creating an illusion of anomalous price behaviour and momentum trading profit opportunity when, in fact, none exists (see also Korajczyk and Sadka (2004) for a trading cost critique). Novy-Marx (2012) finds that recent winners that were intermediate horizon losers (measured over the period from 12 to 7 months prior) significantly underperform recent losers that were intermediate horizon winners. This fact is inconsistent with the traditional view of momentum, that rising stocks tend to keep rising, while falling stocks tend to keep falling. Therefore, this author concludes that momentum does not accurately describe the returns to buying winners and selling losers.

[2] Chan, Jegadeesh and Lakonishok (1996) also confirm the profitability of price momentum strategies over the 1977–1993 period.

[3] They use the Jegadeesh and Titman (1993) momentum strategy 6-month assessment period and 6-month holding period.

over the period 1994–2005. It would be interesting, therefore, to examine which underlying force(s) [or component(s)] leads some countries to exhibit or not exhibit (or to exhibit very weakly) the momentum phenomenon.

The purpose of this paper is to examine the differences in the underlying forces determining momentum profits between countries exhibiting and not exhibiting the momentum phenomenon and to induce which specific component(s) drives momentum profits. To determine the underlying forces of momentum profits, we use the decomposition method for momentum profits of Lo and MacKinlay (1990). These authors decompose momentum profits into three components: (1) the first-order serial covariance of market returns, (2) the average of first-order serial covariances of all individual assets and (3) the cross-sectional dispersion in unconditional mean returns of individual assets. Total momentum profit equals, referring to the three components listed above, minus (1) plus (2) plus (3) [i.e. –(1)+(2)+(3)]. That is, the first term contributes negatively, and the second and third terms contribute positively to momentum profits. The first two components reflect the intertemporal behaviour [−(1)+(2)], and the third component reflects the cross-sectional behaviour of asset returns [+(3)].

As representative countries, we select 14 major countries: Australia, Canada, France, Germany, Italy, the Netherlands, Sweden, Switzerland, the UK and the USA as the group of countries exhibiting momentum, and Hong Kong, Japan, Korea, and Taiwan as the group of non-momentum countries. Over the whole sample period from January 1990 to December 2010, we compute the value of each of the decomposed components of these two groups of countries and compare the computed values between these two groups. Most sample countries show a negative value for the component reflecting intertemporal behaviour [i.e. −(1)+(2)]. Of course, the component reflecting cross-sectional behaviour of asset returns [i.e. (3)] is always positive. We find remarkable differences in component values between these two country groups. The countries exhibiting momentum show that cross-sectional dispersion in unconditional mean returns (positive value) dominates the component reflecting the intertemporal behaviour of asset returns (negative value). Meanwhile, the countries not exhibiting momentum show that the positive contribution to momentum profits by the cross-sectional dispersion in unconditional mean returns is slightly greater than the negative contribution by the component reflecting intertemporal behaviour. As a result, the combined contribution is a small amount of momentum profits in this group. Further, we find that the magnitude of momentum profits is proportional to the relative contribution of the cross-sectional variance in unconditional mean returns. In other words, countries with greater relative contribution from the cross-sectional variance in unconditional mean returns tend to have greater momentum profits. These results are robust over the two subperiods: 1990–1999 and 2000–2010.

Our empirical results indicate that intermediate-term, return-based strategies can be profitable when the cross-sectional dispersion in unconditional mean returns dominates the component reflecting the intertemporal behaviour of asset returns. This suggests that higher (lower) returns of past winners (losers) in the holding period result from their higher (lower) unconditional expected returns rather than from the delayed response in price or other intertemporal regularities caused by investor irrationality. In that the cross-sectional difference in unconditional expected returns is determined by the degree of riskiness of each firm, our results are consistent with risk-based explanations (e.g. Conrad and Kaul, 1998; Berk, Green, and Naik, 1999; Chordia and Shivakumar, 2002; Johnson, 2002; Ahn *et al*., 2003; Bansal *et al*., 2005; Dittmar *et al*., 2007; Sagi and Seasholes, 2007; and Liu and Zhang, 2008; among many others) for the momentum phenomenon rather than behaviour-based explanations (e.g. Daniel *et al*., 1998; Barberis *et al*., 1998; Hong and Stein, 1999; Hong, Lim, and Stein, 2000; Chui *et al*., 2010; among many others). We also find that the magnitude of momentum profits is positively related to the contribution from the cross-sectional variance in expected return. That is, countries with greater contribution from the cross-sectional variance in expected return tend to show greater momentum profits. In a cross-country study, Chui *et al*. (2010) recently document that individualism, which is related to overconfidence and self-attribution bias, is positively associated with the magnitude of momentum profits.[4] Both our own and their results suggest variables to explain the magnitude of momentum profits in international stock markets; the former suggests the contribution from cross-sectional variance in expected return, while the latter suggests the degree of individualism. These results contrast with each other in that one is consistent with a risk-based explanation for the momentum phenomenon across countries and the other is consistent with a behaviour-based explanation. It would be an interesting research question to examine whether these two explanations can be reconciled or whether individualism affects the cross-sectional dispersion in expected return.

Our results also contrast with Grundy and Martin (2001), who argue, by using a particular factor model such as the Fama and French (1993) factor model, that momentum profits are not entirely explained by the cross-sectional difference in expected returns. The use of a mis-specified factor model could generate results *unfavorable* to explaining momentum profits by the cross-sectional variance in expected return. Fama and French (1996) show that their three-factor model fails to explain momentum profits. We argue, therefore, that until a well-specified factor model for the momentum phenomenon

[4] Their results on the relation between individualism and momentum profits are not dampened even after adjusting for other country-specific variables, such as trading volume, volatility, firm size, analyst forecast dispersion, transaction costs and familiarity of the market to foreigners.

emerges, it would be premature to fully support the Grundy and Martin (2001) arguments.

The rest of this paper is organized as follows: Section 2 describes the data, Section 3 presents the empirical results, and Section 4 sets forth our conclusions.

2. Data

According to Griffin *et al.* (2003), most European and several American countries show a strong momentum phenomenon, while Asian countries show no such phenomenon. Therefore, we select 10 representative countries (Australia, Canada, France, Germany, Italy, the Netherlands, Sweden, Switzerland, the UK and the USA) from the group showing a momentum phenomenon and four representative countries (Hong Kong, Japan, Korea and Taiwan) from the group showing no momentum phenomenon. One criteria for a particular country to be included in the sample is that it should have enough traded firms to form momentum portfolios. The sample country should have at least 100 traded firms as of December of each year from 1990 through 2010. Firms with monthly return data of more than 3 years available as of December of each year in Datastream are included in the sample. The sample period is from January 1990 to December 2010. If a country has multiple stock exchanges, we use the representative stock exchange. To compare the results obtained from Datastream with those from another data source, we include results for U.S. firms obtained from the Center for Research in Security Prices (CRSP) as a benchmark. Since we select NYSE firms from Datastream by regarding NYSE as a representative exchange in the USA, we also select only NYSE firms from the CRSP.

Table 1 shows the number of firms for each country in each year from 1990 through 2010. The sample countries have enough listed firms in each year to form momentum portfolios. Table 2 presents average monthly returns (in Panel A) and standard deviations (in Panel B) for each country in each year.[5] The results for the USA, obtained from the CRSP, dubbed as U.S. (CRSP), are similar to those from Datastream.

3. Empirical results

3.1. Momentum profits by each country

Momentum portfolios are formed exactly in the same way as in Jegadeesh and Titman (1993). That is, each month all sample firms in each country are

[5] For the USA, we also use NYSE-traded stocks from the CRSP database to compare the results obtained from Datastream. However, the results for the USA are qualitatively similar.

Table 1
Number of stocks of each sample country

Year	Australia	Canada	France	Germany	Hong Kong	Italy	Japan	Korea	Netherland	Sweden	Switzerland	Taiwan	UK	USA	U.S. (CRSP)
1990	362	326	138	300	243	185	1692	520	144	101	182	175	939	796	1361
1991	397	337	145	318	284	189	1759	530	146	111	181	201	970	824	1412
1992	427	341	155	303	342	194	1783	539	149	119	188	227	977	872	1504
1993	491	373	165	321	397	196	1828	550	150	132	203	254	1000	948	1598
1994	589	410	213	326	443	201	1911	576	158	158	195	275	1033	1028	1668
1995	621	430	235	348	460	207	1990	601	162	172	212	309	1082	1090	1747
1996	919	471	321	370	487	205	2049	648	168	198	218	371	1185	1150	1851
1997	965	526	400	393	554	209	2105	680	185	244	217	414	1262	1206	1939
1998	974	559	483	457	583	219	2134	681	201	290	236	464	1280	1222	1944
1999	1000	606	558	611	611	246	2177	700	211	331	244	538	1294	1228	1901
2000	1112	638	660	747	682	273	2246	701	203	367	262	598	1399	1203	1782
2001	1137	642	687	777	733	281	2273	689	180	361	263	632	1394	1231	1651
2002	1152	678	662	751	800	277	2260	687	165	347	262	676	1409	1261	1571
2003	1191	717	652	744	843	262	2275	680	160	335	258	706	1371	1296	1520
2004	1313	788	634	738	863	257	2342	674	153	343	253	721	1508	1368	1515
2005	1419	868	633	778	885	262	2362	668	144	368	253	720	1688	1439	1522
2006	1558	954	697	900	933	274	2407	685	143	406	255	730	1797	1484	1501
2007	1720	1022	737	1042	1019	294	2413	701	140	465	257	732	1778	1553	1479
2008	1707	1059	688	1059	1037	287	2377	716	126	466	257	731	1641	1583	1421
2009	1658	1053	677	1018	1034	270	2303	698	120	444	252	735	1471	1584	1354
2010	1601	1059	617	971	1028	261	2240	680	112	424	243	726	1332	1585	1307

This table presents the number of common stocks of each sample country used in computing monthly returns for each year. Common stocks that have return observations for more than 3 years are included in the sample. The return data are obtained from Datastream. If a country has multiple stock exchanges, we use the representative stock exchange. 'U.S. (CRSP)' indicates results obtained from the CRSP, in which only NYSE firms are included. The sample period is from January 1990 to December 2010.

Table 2
Average monthly return and volatility

Year	Australia	Canada	France	Germany	Hong Kong	Italy	Japan	Korea	Netherland	Sweden	Switzerland	Taiwan	UK	USA	U.S. (CRSP)
Panel A: Average return (%)															
1990	−3.15	−2.00	−0.88	0.19	1.52	−1.32	−2.76	−1.32	−0.94	−3.65	−1.96	−2.50	−2.58	−1.03	−1.62
1991	4.68	1.42	0.32	−0.23	1.50	−0.53	0.10	−1.59	0.19	−2.22	−0.72	2.02	0.78	3.02	3.15
1992	1.11	3.41	−1.32	−1.14	1.47	−1.49	−2.21	3.30	−0.95	−1.51	−1.21	−2.18	0.27	1.76	1.70
1993	6.54	6.16	2.32	2.19	6.16	1.23	1.12	3.29	2.52	7.31	3.65	4.59	3.74	1.66	1.36
1994	−0.38	0.15	−0.31	0.05	−4.28	0.53	1.54	3.44	0.92	1.39	−0.24	1.72	0.04	−0.10	0.05
1995	0.74	2.09	−1.18	−0.57	−0.01	−1.17	0.21	−2.36	0.60	0.83	0.12	−1.90	1.04	2.13	2.20
1996	3.09	3.72	1.41	0.07	3.15	0.07	−0.65	0.66	2.35	4.01	0.91	3.16	1.13	1.88	1.77
1997	−1.16	0.47	1.34	1.93	−0.53	3.31	−4.43	−5.12	1.92	1.77	1.83	2.26	0.61	2.22	2.26
1998	−0.15	−1.07	1.16	2.19	−2.68	3.34	1.09	6.20	0.45	−0.71	0.98	−1.66	−0.86	0.35	0.20
1999	4.17	2.52	3.18	3.12	4.73	3.56	2.27	2.42	1.51	5.68	2.21	0.02	4.27	0.48	0.37
2000	−0.22	0.76	1.32	−1.64	−1.62	0.53	−0.52	−2.63	−0.90	−1.79	1.03	−4.43	−0.43	1.63	1.18
2001	−0.53	0.68	−1.15	−2.98	0.44	−2.12	−0.48	3.68	−1.43	−1.02	−2.31	3.01	−1.66	1.63	1.68
2002	−0.32	2.69	−1.42	−3.68	−1.67	−1.51	−0.98	−1.45	−2.85	−2.56	−2.21	1.23	−2.40	−0.04	−0.75
2003	3.85	5.33	2.00	3.64	3.17	1.29	3.62	0.74	2.82	3.06	2.17	2.62	3.23	3.34	3.20
2004	1.34	1.75	2.17	0.96	1.50	0.79	2.36	0.58	1.72	1.98	1.21	−0.16	1.06	2.01	1.89
2005	0.70	1.92	2.69	2.94	0.07	2.12	4.04	6.37	2.18	3.84	2.19	0.56	0.76	1.03	0.69
2006	3.13	2.27	2.19	0.78	2.79	1.49	−1.37	0.37	2.09	1.72	2.27	3.09	0.77	1.65	1.62
2007	1.39	0.31	0.09	−0.16	5.41	−0.81	−1.59	2.65	0.10	−1.62	0.74	0.63	−0.88	0.09	0.05
2008	−7.12	−5.61	−3.99	−3.89	−6.34	−5.10	−3.42	−3.91	−4.45	−5.31	−3.65	−4.28	−5.93	−3.77	−4.00
2009	6.41	6.25	2.78	1.21	8.10	1.96	1.18	3.70	2.74	4.15	2.16	7.57	3.97	4.49	4.27
2010	1.86	3.00	0.79	1.46	2.07	−0.36	0.83	1.03	0.19	0.11	1.10	1.01	1.59	2.24	2.38
Panel B: Standard deviation (%)															
1990	−6.40	7.74	5.17	2.89	7.52	3.89	2.58	1.87	2.33	3.60	2.57	4.36	3.73	3.29	4.93
1991	9.26	7.72	6.15	2.40	3.94	1.99	2.50	3.25	2.12	5.77	3.47	3.14	4.10	4.18	5.28
1992	7.61	7.48	5.10	2.16	4.98	2.17	2.05	3.11	2.32	5.56	3.70	2.87	4.65	3.67	6.14
1993	7.62	8.40	4.73	2.51	7.24	3.37	2.34	3.75	3.64	5.59	4.11	5.26	4.89	4.42	3.71

Table 2 (continued)

Year	Australia	Canada	France	Germany	Hong Kong	Italy	Japan	Korea	Netherland	Sweden	Switzerland	Taiwan	UK	USA	U.S. (CRSP)
1994	5.55	5.29	4.85	2.62	4.17	4.63	2.42	5.20	2.20	3.00	2.41	4.34	3.53	2.72	3.46
1995	6.64	6.20	5.47	2.72	3.96	3.15	2.31	3.25	3.31	3.57	4.20	3.45	4.24	3.30	3.86
1996	7.96	6.48	6.89	3.65	4.90	2.90	2.39	6.69	3.33	4.73	4.38	3.71	4.73	2.84	4.39
1997	6.23	7.63	5.21	5.47	7.00	4.23	3.96	5.32	3.47	5.00	3.90	4.10	4.19	3.13	4.03
1998	5.54	5.84	7.72	8.35	5.74	4.13	3.89	7.20	3.96	4.73	4.38	3.58	4.46	3.90	4.63
1999	8.66	7.39	9.85	13.35	8.51	12.77	6.00	7.41	7.14	10.85	5.16	7.93	8.98	4.91	5.74
2000	7.56	8.52	8.79	8.36	7.16	5.99	4.42	6.34	6.38	7.17	4.99	5.56	6.30	4.83	6.68
2001	6.92	7.37	6.98	6.31	7.32	2.89	3.93	6.23	5.21	5.68	3.65	5.41	5.48	4.14	6.87
2002	6.97	7.47	7.04	6.35	7.09	3.32	3.62	6.81	5.72	5.39	4.08	5.34	5.93	3.44	5.03
2003	7.36	7.59	6.75	6.19	7.44	2.71	4.52	5.28	5.18	5.47	4.66	3.80	6.29	3.45	3.74
2004	6.37	5.39	6.21	4.96	5.87	3.59	4.10	6.15	3.37	4.44	2.72	3.72	5.86	3.20	3.00
2005	6.10	5.43	6.00	5.51	6.04	6.17	6.08	7.57	3.37	5.18	2.43	4.64	5.75	3.40	3.65
2006	7.89	5.88	5.50	5.37	7.55	2.32	3.25	3.54	3.16	5.09	3.10	6.02	5.44	2.59	3.06
2007	6.84	5.39	5.50	7.03	8.24	3.27	3.40	6.36	3.11	5.69	2.99	3.79	5.42	3.54	3.81
2008	6.63	5.56	6.39	5.70	5.38	3.44	4.28	4.08	4.89	5.63	3.95	3.46	6.86	4.08	5.22
2009	9.25	6.18	9.04	6.77	6.28	3.69	4.59	5.69	5.99	6.23	2.78	4.27	8.38	4.90	6.26
2010	7.02	4.75	5.49	6.79	5.34	3.01	3.05	5.32	7.55	6.22	2.39	2.98	5.97	2.66	3.08

This table presents the average monthly returns and standard deviations in each year of common stocks that have return observations more than 3 years. The return data are obtained from Datastream. If a country has multiple stock exchanges, we use the representative stock exchange. 'U.S. (CRSP)' indicates the results obtained from the CRSP in which NYSE firms only are included.

sorted into 1 of 10 decile portfolios based on past J-month (assessment period) returns and held for K (holding period) months. Thus, portfolios have overlapping holding periods. All portfolios are equally weighted. In fact, Jegadeesh and Titman consider four different assessing periods (J = 3, 6, 9 and 12 months) and four different holding periods (K = 3, 6, 9 and 12 months). Thus, they consider 16 different momentum strategies. Since the 6-month/6-month strategy tends to be regarded as the representative relative strength strategy in the literature, we construct momentum portfolios by setting J = 6 months and K = 3, 6, 9, or 12 months in our analysis. We also repeat our analysis using the other sets of momentum portfolios, but the results are qualitatively similar.[6]

Table 3 reports average returns on the momentum portfolios by setting J/K = 6-month/6-month strategy in each country over the period January 1990 through December 2010.[7] P1 (loser) is the portfolio with the lowest past performance, while P10 (winner) is the portfolio with the highest past performance. 'P10-P1' indicates WML (winner minus loser), which is the return on the zero-investment portfolio by selling short the loser portfolio (P1) and buying long the winner portfolio (P10). Consistently with Griffin *et al.* (2003), Australia, Canada, France, Germany, Italy, the Netherlands, Sweden, Switzerland, the UK and the USA show significant momentum profits. That is, momentum profits (per month) for these 10 countries are 0.47 per cent for Australia (t-statistic of 2.53), 0.77 per cent for Canada (t-statistic of 3.88), 1.31 per cent for France (t-statistic of 6.60), 0.98 per cent for Germany (t-statistic of 5.04), 1.06 per cent for Italy (t-statistic of 5.96), 1.57 per cent for the Netherlands (t-statistic of 7.29), 0.87 per cent for Sweden (t-statistic of 3.30), 1.47 per cent for Switzerland (t-statistic of 7.63), 1.25 per cent for the UK (t-statistic of 6.22) and 0.62 per cent for the USA (t-statistic of 2.96). Among these countries, many show momentum profits of more than one per cent per month. Meanwhile, the Asian countries show insignificant (even negative) or small momentum profits. Specifically, the momentum profits of Hong Kong, Japan, Korea and Taiwan are 0.27 per cent (t-statistic of 1.32), −0.20 per cent (t-statistic of −1.10), −0.40 per cent (t-statistic of −1.63) and 0.09 per cent (t-statistic of 0.40), respectively. Among these four Asian countries, Hong Kong shows the highest momentum profit; however, its magnitude is much smaller than that of the European and North American countries, and moreover, it is statistically insignificant. We hereafter term momentum profits in the same way as in Jegadeesh and Titman (1993), '*JT* momentum profits'.

[6] Results are available upon request.

[7] The first assessment period is from July 1989 through December 1989, and the first holding period is from January 1990 through June 1990.

Table 3
Average monthly returns on portfolios sorted by past 6-month performance

Portfolio	Australia	Canada	France	Germany	Hong Kong	Italy	Japan	Korea	Netherland	Sweden	Switzerland	Taiwan	UK	USA	U.S. (CRSP)
P1(loser)	1.38	2.01	0.23	−0.40	1.09	−0.30	0.14	1.00	−0.30	0.78	−0.05	0.67	0.09	1.53	0.95
P2	0.99	1.21	0.56	0.09	1.22	0.37	0.15	1.56	0.67	1.05	0.58	0.77	0.43	0.97	1.05
P3	0.81	1.34	0.21	−0.20	1.11	0.17	0.18	1.59	0.36	0.88	0.44	0.76	0.19	0.99	1.04
P4	0.86	1.15	0.31	0.10	1.10	0.30	0.16	1.49	0.47	0.68	0.53	0.81	0.34	0.94	1.06
P5	0.99	1.21	0.56	0.09	1.22	0.37	0.15	1.56	0.67	1.05	0.58	0.77	0.43	0.93	1.05
P6	1.10	1.31	0.54	0.12	1.21	0.32	0.11	1.50	0.69	1.03	0.68	0.79	0.66	0.97	1.05
P7	1.29	1.52	0.73	0.24	1.30	0.60	0.08	1.46	0.77	0.9	0.90	0.73	0.74	1.09	1.08
P8	1.59	1.94	0.88	0.45	1.32	0.57	0.07	1.45	0.82	1.15	1.01	0.85	0.83	1.11	1.09
P9	1.90	2.28	1.15	0.47	1.37	0.55	0.02	1.40	0.94	1.41	1.12	0.67	1.04	1.30	1.17
P10 (winner)	1.85	2.79	1.55	0.58	1.35	0.81	−0.07	0.62	1.26	1.65	1.42	0.76	1.34	2.15	1.43
P10-P1	0.47	0.77	1.31	0.98	0.27	1.06	−0.20	−0.40	1.57	0.87	1.47	0.09	1.25	0.62	0.47
(or WML)	(2.53)	(3.38)	(6.60)	(5.04)	(1.32)	(5.96)	(−1.10)	(−1.63)	(7.29)	(3.30)	(7.63)	(0.40)	(6.22)	(2.96)	(2.11)

This table reports the average monthly returns (in per cent) for momentum portfolios formed according to the past-6-month returns and held for 6 months. At the end of each month, all stocks in each country are sorted into 1 of 10 decile portfolios based on the past 6-month returns. All portfolios are equally weighted. P1 (loser) is the portfolio with the lowest past performance, while P10 (winner) is the portfolio with the highest past performance. 'P10-P1' indicates WML (winner minus loser), which is the return on the zero-investment portfolio by selling short the loser portfolio (P1) and buying long the winner portfolio (P10). *t*-Statistics are reported in parentheses. The sample period is from January 1990 to December 2010.

To confirm the above results with different holding periods, we also examine momentum profits with holding periods of $K = 3$, 9 and 12 months. Table 4 presents the momentum profits for these holding periods. With these different holding periods, momentum profits of the 10 European and North American countries are still strongly statistically significant, except for a few cases. Among these 10 countries, Switzerland shows the strongest momentum phenomenon. Hong Kong shows significant momentum profits only for the $K = 3$ months holding period, but insignificant momentum profits for the other holding periods (even a negatively significant momentum profit for the $K = 12$ months holding period). Japan and Taiwan show no momentum profits

Table 4
Momentum profits by each country

	Monthly returns (%)			
Country	$K = 3$ months	$K = 6$ months	$K = 9$ months	$K = 12$ months
Countries showing momentum				
Australia	0.82 (3.03)***	0.47 (2.53)***	0.29 (1.81)*	−0.06 (−0.45)
Canada	0.61 (1.94)*	0.77 (3.38)***	0.75 (3.93)***	0.43 (2.67)***
France	1.51 (4.90)***	0.92 (6.60)***	1.01 (5.35)***	0.62 (4.02)***
Germany	1.22 (4.80)***	0.98 (5.04)***	0.81 (4.59)***	0.50 (3.50)***
Italy	1.06 (4.06)***	1.06 (5.96)***	1.06 (6.79)***	0.81 (6.87)***
Netherland	1.77 (5.54)***	1.57 (7.29)***	1.20 (6.47)***	0.92 (5.69)***
Sweden	1.53 (4.44)***	0.87 (3.30)***	0.52 (2.22)**	0.30 (1.64)*
Switzerland	1.65 (6.20)***	1.47 (7.63)***	1.24 (7.59)***	1.03 (7.63)***
UK	1.69 (6.22)***	1.25 (6.22)***	1.01 (5.52)***	0.68 (4.48)***
USA	0.67 (2.58)***	0.62 (2.96)***	0.43 (2.47)***	0.18 (1.65)*
U.S. (CRSP)	0.58 (1.97)**	0.47 (2.11)**	0.38 (1.79)*	0.15 (1.14)
Average	1.25 (9.02)***	1.00 (8.97)***	0.83 (7.98)***	0.54 (5.02)***
Countries showing no momentum				
Hong Kong	0.60 (2.23)**	0.27 (1.32)	−0.25 (−1.39)	−0.37 (−2.46)**
Japan	−0.22 (−0.88)	−0.20 (−1.10)	−0.19 (−1.43)	−0.29 (−2.76)***
Korea	−0.34 (−1.07)	−0.38 (−1.63)	−0.84 (−4.46)***	−0.80 (−4.93)***
Taiwan	−0.30 (−0.98)	0.09 (0.40)	−0.07 (−0.39)	−0.10 (−0.88)
Average	−0.07 (−0.29)	−0.06 (−0.38)	−0.34 (−1.97)**	−0.39 (−2.64)***

This table presents momentum profit (in per cent) for each country, which is the return on the zero-investment portfolio (WML; winner minus loser) by selling short the loser portfolio and buying long the winner portfolio. Momentum portfolios are formed according to the past-6-month returns ($J = 6$ months) and held for $K = 3$, 6, 9, or 12 months. At the end of each month, all stocks in each country are sorted into 1 of 10 decile portfolios based on the past-6-month returns. The sample period is from January 1990 to December of 2010 All portfolios are equally weighted. *t*-Statistics are reported in parentheses. The *t*-statistics of the averages are based on the momentum profits of the sample countries. The results for the U.S. (CRSP) are not included in computing averages. ***1 per cent significant; **5 per cent significant; *10 per cent significant.

over all holding periods. Korea also shows no momentum profits. One interesting feature of Korea is that it shows even strong contrarian profits with the $K = 9$ and $K = 12$ months holding periods, which is the reverse of momentum profits, or a reversal effect. Momentum profits with the $K = 9$ and $K = 12$ months holding periods in Korea are −0.84 per cent (with t-statistic of −4.46) and −0.80 per cent (with t-statistic of −4.93), respectively. Therefore, we classify the 10 European and North American countries as momentum countries and the four Asian countries as non-momentum countries. The results for the USA, obtained from Datastream and the CRSP, are similar. The average momentum profits of the 10 momentum countries are 1.25 per cent, 1.00 per cent, 0.83 per cent and 0.54 per cent for $K = 3$, 6, 9 and 12 months, respectively, all strongly statistically significant. Note that the results for the USA obtained from the CRSP are not included in computing averages. Meanwhile, average momentum profits for the four non-momentum countries are −0.07 per cent, −0.06 per cent, −0.34 per cent and −0.39 per cent, respectively, all statistically insignificant.

3.2. *The decomposition of momentum profits*

The previous results, that momentum is not a universal phenomenon, and its magnitude differs across countries, suggest that there may be different patterns in time-series and cross-sectional behaviour of stock returns for each country. In this section, therefore, by decomposing momentum profits into several components, we examine which components of stock price behaviour do and do not cause momentum profits.

Lehmann (1990) and Lo and MacKinlay (1990) suggest an elegant way to decompose momentum profits (or contrarian profits) into several components. We follow their approach. The investment weight received by security i in the momentum strategy at given month t is given by

$$w_{it}(j) = \frac{1}{N}(r_{it-1} - r_{mt-1}), \tag{1}$$

where $r_{mt-1} = (1/N)\Sigma_{i=1}^{N} r_{it-1}$ is the equal-weighted market return at time $t - 1$, and j is the length of $[t - 1, t]$, the assessing period.[8] The weight given to each security in the momentum strategy depends on the previous period's performance relative to the market return. At time t (the beginning of the portfolio formation period), that is, losers whose past returns are less than the market return are sold short and winners whose past returns are greater than the market return are bought long. The sum of the weights equals zero, which is a zero-investment portfolio. That is,

[8] Investment weights for contrarian strategies are determined by $w_{it} = -(1/N)(r_{it-1} - r_{mt-1})$.

$$\sum_{i=1}^{N} w_{it} = 0. \tag{2}$$

Then, the momentum profit, π_t, from this strategy is given by

$$\pi_t(j) = \sum_{i=1}^{N} w_{it} r_{it}. \tag{3}$$

By taking the expectation in equation (3), the expected momentum profit with assessing period j is

$$\begin{aligned} E[\pi_t(j)] &= -Cov(r_{mt}, r_{mt-1}) + \frac{1}{N}\sum_{i=1}^{N} Cov(r_{it}, r_{it-1}) + \frac{1}{N}\sum_{i=1}^{N}(\mu_i - \mu_m)^2 \\ &= -C_t(j) + O_t(j) + M_t(j) \end{aligned} \tag{4}$$

where $C_t(j) = Cov(r_{mt}, r_{mt-1})$ is the first-order (or j-month lagged) serial covariance of the market returns, $O_t(j) = (1/N)\Sigma_{i=1}^{N} Cov(r_{it}, r_{it-1})$ is the average of the first-order serial covariances of the N individual stocks, and $M_t(j) = (1/N)\Sigma_{i=1}^{N}(\mu_i, \mu_m)^2$ is the cross-sectional variance of unconditional mean returns of individual stocks.[9] We let,

$$P_t(j) = -C_t(j) + O_t(j). \tag{5}$$

Then, $P_t(j)$ indicates the contribution to the expected momentum profits from time-series predictability of asset returns. Conrad and Kaul (1998) term this predictability–profitability index. The third term, $M_t(j)$, indicates the contribution to expected momentum profits from cross-sectional dispersion in mean returns of assets, under the assumption of stationarity of mean returns. Even though asset prices follow a random walk [i.e. $C_t(j) = O_t(j) = 0$], the expected momentum profits can still exist, due to cross-sectional dispersion in unconditional mean returns. We hereafter term momentum profits of equation (3) or (4) '*LM* momentum profits' to differentiate them from '*JT* momentum profits' made in the same way as in Jegadeesh and Titman (1993).

3.3. Empirical results of decomposition of momentum profits

Table 5 shows LM momentum profits based on the trading strategy of selling short stocks with returns lower than the market returns and buying long stocks

[9] In fact, the first-order serial covariance of the market returns, $Cov\ (r_{mt}, r_{mt-1})$, is the average of all one-lagged and one-lead own- and cross-covariances of N individual stocks.

Table 5
Momentum profits by Lo and MacKinlay's (1990) strategy

Country	Momentum profits (%) $\bar{\pi}(j)$
Momentum countries	
Australia	0.17 (0.44)
Canada	0.40 (0.74)
France	1.07 (2.77)***
Germany	1.20 (2.89)***
Italy	1.17 (3.58)***
Netherland	1.04 (4.21)***
Sweden	0.48 (1.24)
Switzerland	1.33 (3.43)***
UK	1.16 (2.80)***
USA	0.48 (1.65)*
U.S. (CRSP)	1.35 (1.05)
Average	0.85 (6.43)***
Non-Momentum countries	
Hong Kong	−0.30 (−0.65)
Japan	−0.97 (−2.20)**
Korea	−0.70 (−1.15)
Taiwan	−0.10 (−0.22)
Average	−0.52 (−2.64)***

This table presents momentum profits (in per cent) as suggested Lo and MacKinlay (1990). That is, the investment weight received by a security i at a given month t is given by

$$w_{it}(j) = (1/N)(r_{it-1} - r_{mt-1}),$$

where $r_{mt-1} = (1/N)\Sigma_{i=1}^{N} r_{it-1}$ is the equal-weighted market return at time $t - 1$, and j is the length of $[t - 1, t]$, the assessing period. Here j is 6 months. This is a zero-cost trading strategy that buys past winners and sells short past losers, based on their past performance relative to the performance of an equal-weighted market index. Momentum profits at time t are determined by

$$\pi_t(j) = \Sigma_{i=1}^{N} w_{it} r_{it}.$$

The time-series average of $\pi_t(j)$ is reported as $\bar{\pi}(j) = (1/T)\Sigma_{t=1}^{T} \pi_t(j)$. The sample period is from January 1990 to December 2010. t-Statistics are reported in parentheses. ***1 per cent significant, **5 per cent significant, *10 per cent significant. The results for the U.S. (CRSP) are not included in computing averages. The t-statistic of the averages is based on the values of the momentum profits of the sample countries.

with returns greater than the market returns, as in equation (1). We set the length of one period $[t - 1, t]$ at 6 months. These momentum profits are the time-series average of profits made at month t, $\mu_t(j)$, t = January 1990 through December 2010. LM momentum profits of the 10 momentum countries are 0.17 per cent (0.44 per cent) for Australia, 0.40 per cent (0.74 per cent) for Canada, 1.07 per cent (2.77 per cent) for France, 1.20 per cent (2.89 per cent) for Germany, 1.17 per cent (3.58 per cent) for Italy, 1.04 per cent (4.21 per cent) for the Netherlands, 0.48 per cent (1.24 per cent) for Sweden, 1.33

per cent (3.43 per cent) for Switzerland, 1.16 per cent (2.80 per cent) for the UK, and 0.48 per cent (1.65 per cent) for the USA. All are statistically significant except for Australia, Canada and Sweden. However, LM momentum profits of these three countries are much greater than those of the non-momentum countries. LM momentum profits of the four non-momentum countries are all negative; they are −0.30 per cent (−0.65 per cent), −0.97 per cent (−2.20 per cent), −0.70 per cent (−1.15 per cent) and −0.10 per cent (−0.22 per cent), respectively. All are statistically insignificant. The magnitude of LM momentum profits is slightly different from that of JT momentum profits. However, the ranking and the sign of both momentum profits are almost identical, and they are highly correlated. The correlation coefficient between the LM and JT momentum profits is 0.835. The average value of LM momentum profits of the 10 momentum countries is 0.85 per cent (with t-statistic of 6.43), while that of the four non-momentum countries is −0.52 per cent (with t-statistic of −2.64).

To determine which component(s) makes the difference in momentum profits between the momentum countries and the non-momentum countries, we compute the value of each component in equation (4). Table 6 presents the time-series averages of each of the three components [$C_t(j)$, $O_t(j)$, and $M_t(j)$] and the expected momentum profits over the whole sample period, which are the sum of the three components.[10] The results show that among the three components, the component of the cross-sectional dispersion in mean asset returns, $\bar{M}(j)$, is greater in the momentum countries than the other components, reflecting the intertemporal behaviour of asset returns. The average values of $\bar{M}(j)$ in these two groups are 2.616 and 1.278, respectively. However, the components reflecting the intertemporal behaviour of asset returns, $\bar{C}(j)$ and $\bar{O}(j)$, are greater in the non-momentum countries than $\bar{M}(j)$. Note that $\bar{M}(j)[=\Sigma_{t=1}^{T} M_t(j)]$ is the time-series average of cross-sectional variances in unconditional mean stock returns, $\bar{C}(j)[=\Sigma_{t=1}^{T} C_t(j)]$ is the time-series average of the first-order serial covariances of the market returns, and $\bar{O}(j)[=\Sigma_{t=1}^{T} O_t(j)]$ is the time-series average of the averages of all first-order serial covariances of N individual stocks. All four non-momentum sample countries have negative values of $\bar{O}(j)$, which indicates that these countries exhibit a short-term reversal in stock return, while the momentum countries tend to have positive values of $\bar{O}(j)$.[11]

[10] We first calculate the value of each of the three components and sum these values to the expected profits at month t and then compute time series averages of the values of each component.

[11] It may be argued that the negative serial correlation of the non-momentum countries is caused by price limits. Korea has a price limit of 15 per cent per day, and Japan has a price limit of 20–30 per cent per day for individual stocks. However, countries with no price limit such as Hong Kong, Canada and the USA also exhibit a negative serial correlation. Therefore, it is difficult to say that the price limit could cause a negative serial correlation.

Table 6
Relative importance of each component of momentum profits over the entire sample period

Country	Expected profit $E[\pi_t(j)][= \bar{P}(j) + \bar{M}(j)]$	$\bar{C}(j)$	$\bar{O}(j)$	$\bar{P}(j)[= -\bar{C}(j) + \bar{O}(j)]$	$\bar{M}(j)$	$\frac{\lvert\bar{P}(j)\rvert}{E[\pi_t(j)]}$	Relative proportion $\frac{\lvert\bar{P}(j)\rvert}{\lvert\bar{P}(j)\rvert+\bar{M}(j)}$	$\frac{\lvert\bar{M}(j)\rvert}{\lvert\bar{P}(j)\rvert+\bar{M}(j)}$	$\frac{\bar{M}(j)}{\lvert\bar{P}(j)\rvert}$
Momentum countries									
Australia	2.807	0.096	−1.599	−1.695	4.501	0.604	−0.274	0.726	2.655
Canada	2.131	−0.580	−1.780	−1.200	3.332	0.563	−0.265	0.735	2.777
France	3.473	−0.041	−0.094	−0.053	3.525	0.015	−0.015	0.985	66.509
Germany	3.759	0.290	0.163	−0.127	3.885	0.034	−0.032	0.968	30.591
Italy	1.091	0.741	0.893	0.152	0.938	0.139	0.139	0.861	6.171
Netherland	1.228	0.120	0.267	0.147	1.081	0.120	0.120	0.880	7.354
Sweden	2.688	0.793	0.120	−0.673	3.336	0.250	−0.168	0.832	4.957
Switzerland	1.192	0.303	0.746	0.443	0.749	0.372	0.372	0.628	1.691
UK	2.416	1.403	−0.167	−1.570	3.985	0.650	−0.283	0.717	2.538
USA	0.658	0.021	−0.144	−0.165	0.823	0.251	−0.167	0.833	4.988
U.S. (CRSP)	1.284	−0.029	−0.507	−0.478	1.762	0.372	−0.213	0.787	3.686
Average	2.071	0.315	−0.160	−0.474	2.616	0.300	−0.057	0.817	13.023
Non-Momentum countries									
Hong Kong	0.760	−0.521	−2.373	−1.852	2.612	2.437	−0.415	0.585	1.410
Japan	−0.139	−1.417	−2.122	−0.705	0.566	5.072	−0.555	0.445	0.803
Korea	−0.408	0.540	−0.884	−1.424	1.015	3.490	−0.584	0.416	0.713
Taiwan	0.490	−0.462	−0.892	−0.430	0.920	0.878	−0.319	0.681	2.140
Average	0.176	−0.466	−1.568	−1.103	1.278	2.969	−0.468	0.532	1.266

This table shows the relative importance of each component of the expected momentum profits, $[\pi_t(j)][= \bar{P}(j) + \bar{M}(j)]$. $\bar{P}(j) = -\bar{C}(j) + \bar{O}(j)$, where $\bar{C}(j)$ is the time-series average of first-order serial covariance of the market returns, and $\bar{O}(j)$ is the time-series average of the average of first-order serial covariances of the N individual assets. $\bar{M}(j)$ is the time-series average of cross-sectional variances of mean returns of the N individual assets. The results for the U.S. (CRSP) are not included in computing averages. The sample period is from January 1990 to December 2010.

To examine the difference in the decomposed component of momentum profits between the momentum and non-momentum countries in more detail, we compute the relative importance of each component. Table 6 apparently shows that the component reflecting the cross-sectional behaviour of asset returns has a greater impact on momentum profits relative to the intertemporal behaviour of asset returns in the momentum countries, rather than in the non-momentum countries. Specifically, the average of the ratios of $\bar{M}(j)$ to the absolute value of $\bar{P}(j)[= -\bar{C}(j) + \bar{O}(j)]$ for the 10 momentum countries is 13.023, while that for the four non-momentum countries is only 1.266. Note that $\bar{P}(j)$ is the time-series average of the predictability–profitability index values reflecting the intertemporal behaviour of asset returns. Also, the impact from the intertemporal behaviour of asset returns on momentum profits is much smaller in the momentum countries than in the non-momentum countries. That is, the ratios of the absolute value of $\bar{P}(j)$ to $E[\pi_t(j)]$ (the expected momentum profits) for the 10 momentum countries are 0.604 for Australia, 0.563 for Canada, 0.015 for France, 0.034 for Germany, 0.139 for Italy, 0.120 for the Netherlands, 0.250 for Sweden, 0.372 for Switzerland, 0.650 for the UK, and 0.251 for the USA, while these ratios for the four non-momentum countries are 2.437 for Hong Kong, 5.072 for Japan, 3.490 for Korea and 0.878 for Taiwan. The averages of the ratios of the absolute value of $\bar{P}(j)$ to $E[\pi_t(j)]$ for the momentum countries and the non-momentum countries are 0.300 and 2.969, respectively.

Table 6 also shows the relative importance of these two components to the expected momentum profits. The ratios of $\bar{P}(j)$ to $|\bar{P}(j)| + \bar{M}(j)$ for four selected countries among the momentum countries, Canada, Germany, the UK, and the USA are −0.265, −0.032, −0.283 and −0.167, respectively, and these countries' ratios of $\bar{M}(j)$ to $|\bar{P}(j)| + \bar{M}(j)$ are 0.735, 0.968, 0.717 and 0.833, respectively. Note that the sum of the ratios in absolute terms for each country equals 1. These results indicate that the component of the cross-sectional behaviour of asset returns, $\bar{M}(j)$, makes most of the contribution to momentum profits in these momentum countries, but the component of the intertemporal behaviour of asset returns, $\bar{P}(j)$, makes only a small negative contribution to momentum profits. We find similar results for the other momentum countries. In the non-momentum countries, however, the component of the intertemporal behaviour of asset returns makes a big negative contribution to momentum profits, and the component of the cross-sectional behaviour of asset returns makes relatively a small positive contribution. Specifically, the ratios of $\bar{P}(j)$ to $|\bar{P}(j)| + \bar{M}(j)$ for Hong Kong, Japan, Korea and Taiwan are −0.415, −0.555, −0.584 and −0.319, respectively, and these countries' ratios of $\bar{M}(j)$ to $|\bar{P}(j)| + \bar{M}(j)$ are 0.585, 0.445, 0.416 and 0.681, respectively. To examine whether the magnitude of momentum profits is proportionally related to the component of the cross-sectional variance in expected returns, we regress JT momentum profits (with $K = 6$ months) on the ratios of $\bar{M}(j)/[|\bar{P}(j)| + \bar{M}(j)]$ for all 14 countries. That is, we estimate the following cross-sectional regression model:

$$[\text{Momentum profit}]_i = a_0 + a_1 \left[\frac{\bar{M}(j)}{|\bar{P}(j)| + \bar{M}(j)} \right]_i + \varepsilon_i, i = 1, \ldots, 14. \quad (6)$$

The estimated slope coefficient, $\hat{a}_1$, is 2.57, with t-statistic of 3.71. The correlation coefficient between these two variables is 0.731. These results indicate that countries with greater contribution from the cross-sectional variance in expected return tend to have greater momentum profits.

To investigate whether the difference in these three components between the two groups persists during subperiods, we divide the whole sample period into two subperiods: January 1990 to December 1999 and January 2000 to December 2010. However, we find results similar to those over the whole period. Table 7 reports the results for the two subperiods.[12] The results for the USA obtained from the CRSP are also similar to those from Datastream over the whole period and the two subperiods.

Figure 1 depicts the above-mentioned relative importance of the two components of each country in the whole sample period. The top part of a bar graph (Panel A) indicates the relative portion contributed by the cross-sectional behaviour of asset returns, $\bar{M}(j)/[|\bar{P}(j)| + \bar{M}(j)]$, and the bottom part (Panel B) indicates the relative portion contributed by the intertemporal behaviour of asset returns to momentum profits, $\bar{P}(j)/[|\bar{P}(j)| + \bar{M}(j)]$.

The results for the subperiods are similar to those for the whole sample period. One noteworthy observation is that the relative contribution of the cross-sectional variance in expected return, $\bar{M}(j)/[|\bar{P}(j)| + \bar{M}(j)]$, is slightly decreased over the two subperiods in the momentum countries, while it is slightly increased in the non-momentum countries.

4. Conclusions

This paper examines the sources of momentum profits of countries exhibiting and not exhibiting momentum by decomposing momentum profits and comparing the difference in the underlying factors determining

[12] In Table 7, the expected momentum profits of the U.S. markets for the second subperiod, January 2000 to December 2010, are low relative to that of the other momentum countries and even to that of the non-momentum countries. In fact, the actual realized momentum profit of the U.S. markets over the second subperiod is quite low, −0.13 per cent per month. Meanwhile, their actual momentum profit over the first subperiod is 1.45 per cent per month. This low momentum profit for the second subperiod is caused by the returns over the financial crisis of 2009. The actual momentum profit for 2009 is −4.76 per cent per month. After excluding 2009, the actual momentum profit over the second subperiod is 0.69 pre cent per month. It might be premature to say, therefore, that momentum has disappeared from the U.S. markets in recent years. This magnitude of momentum profits from our sample is quite similar to that of the momentum profits obtained from the French website (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html).

Table 7
Relative importance of each component of momentum profits over the subperiods

Country	Expected profit $E[\pi_t(j)][= \bar{P}(j) + \bar{M}(j)]$	$\bar{C}(j)$	$\bar{O}(j)$	$\bar{P}(j)[= -\bar{C}(j) + \bar{O}(j)]$	$\bar{M}(j)$	Relative proportion $\frac{\lvert\bar{P}(j)\rvert}{E[\pi_t(j)]}$	$\frac{\lvert\bar{P}(j)\rvert}{\lvert\bar{P}(j)\rvert+\bar{M}(j)}$	$\frac{\lvert\bar{M}(j)\rvert}{\lvert\bar{P}(j)\rvert+\bar{M}(j)}$	$\frac{\bar{M}(j)}{\lvert\bar{P}(j)\rvert}$
Panel A: Sub-period 1 (January 1990 – December 1999)									
Momentum countries									
Australia	4.831	1.392	0.342	−1.050	5.882	0.217	−0.151	0.849	5.602
Canada	4.805	0.109	−0.324	−0.433	5.238	0.090	−0.076	0.924	12.097
France	5.837	−1.113	−1.387	−0.274	6.111	0.047	−0.043	0.957	22.303
Germany	6.436	−0.656	−0.115	0.541	5.895	0.084	0.084	0.916	10.896
Italy	2.958	0.578	0.790	0.212	2.745	0.072	0.072	0.928	12.948
Netherland	2.003	−0.514	−0.721	−0.207	2.210	0.103	−0.086	0.914	10.676
Sweden	4.462	0.689	0.343	−0.346	4.808	0.078	−0.067	0.933	13.896
Switzerland	1.841	−0.237	0.188	0.425	1.417	0.231	0.231	0.769	3.334
UK	4.644	1.004	0.218	−0.786	5.429	0.169	−0.126	0.874	6.907
USA	2.049	0.056	0.274	0.218	1.830	0.106	0.106	0.894	8.394
U.S. (CRSP)	2.053	−0.042	−0.413	−0.371	2.424	0.181	−0.133	0.867	6.534
Average	3.987	0.131	−0.039	−0.170	4.157	0.120	−0.006	0.896	10.705
Non-Momentum countries									
Hong Kong	2.643	−0.386	−1.473	−1.087	3.730	0.411	−0.226	0.774	3.431
Japan	0.712	−2.259	−2.535	−0.276	0.988	0.388	−0.218	0.782	3.580
Korea	0.746	1.150	−0.772	−1.922	2.668	2.576	−0.419	0.581	1.388
Taiwan	2.752	−0.590	−1.007	−0.417	3.169	0.152	−0.116	0.884	7.600
Average	1.713	−0.521	−1.447	−0.926	2.639	0.882	−0.245	0.755	4.000
Panel B: Sub-period 2 (January 2000 – December 2010)									
Momentum countries									
Australia	3.122	−1.024	−3.275	−2.251	5.373	0.721	−0.295	0.705	2.387
Canada	2.429	−1.175	−3.038	−1.863	4.292	0.767	−0.303	0.697	2.304
France	3.832	0.884	1.024	0.140	3.692	0.037	0.037	0.963	26.371
Germany	3.357	1.106	0.404	−0.702	4.059	0.209	−0.148	0.852	5.780

Table 7 (continued)

Country	Expected profit $E[\pi_t(j)][= \bar{P}(j) + \bar{M}(j)]$	$\bar{C}(j)$	$\bar{O}(j)$	$\bar{P}(j)[= -\bar{C}(j) + \bar{O}(j)]$	$\bar{M}(j)$	Relative proportion $\frac{\lvert\bar{P}(j)\rvert}{E[\pi_t(j)]}$	$\frac{\lvert\bar{P}(j)\rvert}{\lvert\bar{P}(j)\rvert+\bar{M}(j)}$	$\frac{\lvert\bar{M}(j)\rvert}{\lvert\bar{P}(j)\rvert+\bar{M}(j)}$	$\frac{\bar{M}(j)}{\lvert\bar{P}(j)\rvert}$
Italy	1.272	0.881	0.982	0.101	1.171	0.079	0.079	0.921	11.594
Netherland	4.717	0.667	1.120	0.453	4.265	0.096	0.119	1.119	9.415
Sweden	3.243	0.883	−0.072	−0.955	4.198	0.294	−0.185	0.815	4.396
Switzerland	1.552	0.768	1.227	0.459	1.093	0.296	0.296	0.704	2.381
UK	2.246	1.747	−0.499	−2.246	4.491	1.000	−0.333	0.667	2.000
USA	0.845	−0.010	−0.505	−0.495	1.342	0.586	−0.269	0.731	2.711
U.S. (CRSP)	1.299	−0.017	−0.588	−0.571	1.870	0.440	−0.234	0.766	3.275
Average	2.662	0.473	−0.263	−0.736	3.398	0.409	−0.100	0.817	6.934
Non-momentum countries									
Hong Kong	1.266	−0.637	−3.151	−2.514	3.780	1.986	−0.399	0.601	1.504
Japan	1.815	−0.689	−1.765	−1.076	2.891	0.593	−0.271	0.729	2.687
Korea	1.722	0.013	−0.981	−0.994	2.716	0.577	−0.268	0.732	2.732
Taiwan	1.145	−0.352	−0.793	−0.441	1.586	0.385	−0.218	0.782	3.596
Average	1.487	−0.416	−1.673	−1.256	2.743	0.885	−0.289	0.711	2.630

This table is analogous to Table 7 except that over the two subperiods, it presents the relative importance of each component of the expected momentum profits, $[\pi_t(j)][= \bar{P}(j) + \bar{M}(j)]$. $\bar{P}(j) = -\bar{C}(j) + \bar{O}(j)$, where $\bar{C}(j)$ is the time-series average of first-order serial covariance of the market returns and $\bar{O}(j)$ is the time-series average of the average of first-order serial covariances of the N individual assets. $\bar{M}(j)$ is the time-series average of cross-sectional variances of mean returns of the N individual assets. The results for the U.S. (CRSP) are not included in computing averages. The sample period is from January 1990 to December 2010.

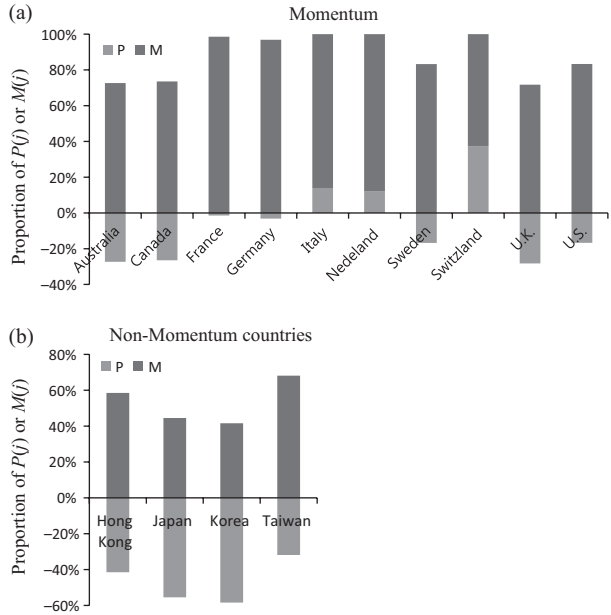

Figure 1 Decomposition of momentum profits. This figure shows the relative magnitude of $\bar{M}(j)$ (the cross-sectional dispersion in unconditional mean stock returns) and $\bar{P}(j)$ (the predictability–profitability index) in the total momentum profits. The part for $\bar{P}(j)$ indicates the relative proportion of $\bar{P}(j)$ to the sum of the absolute values of $\bar{P}(j)$ and $\bar{M}(j)$; that is, it equals $\bar{P}(j)/[|\bar{P}(j)| + \bar{M}(j)]$. Likewise, the part for $\bar{M}(j)$ indicates the relative proportion of $\bar{M}(j)$ to the sum of the absolute values of $\bar{P}(j)$ and $\bar{P}(j)$; that is, it equals $\bar{M}(j)/[|\bar{P}(j)| + \bar{M}(j)]$.

momentum profits between these two country groups. Momentum profits can be decomposed into two components: the component reflecting the cross-sectional difference in unconditional expected returns and the component reflecting the intertemporal behaviour of asset returns. We select 14 major countries: Australia, Canada, France, Germany, Italy, the Netherlands, Sweden, Switzerland, the UK and the USA as a representative group of countries exhibiting the momentum phenomenon, and Hong Kong, Japan, Korea and Taiwan as a representative group of countries not exhibiting the momentum phenomenon.

Most sample countries show a negative value for the component reflecting the intertemporal behaviour of asset returns. We find a remarkable difference between these two groups of countries in the value of the component reflecting the cross-sectional behaviour of expected stock returns. This component has a greater impact on momentum profits relative to the component of the intertemporal behaviour of asset returns in the momentum countries. However, this is not the case in the non-momentum countries. That is, the positive contribution by the component reflecting the cross-sectional behaviour of asset expected returns is slightly greater than the negative contribution by the

component reflecting the intertemporal behaviour of asset returns. As a result, the combined contribution to momentum profits is small in the non-momentum countries. Further, we find that the magnitude of momentum profits is proportional to the relative contribution of the cross-sectional variance in unconditional mean returns. In other words, countries with greater relative contribution from cross-sectional variance in unconditional mean returns tend to have greater momentum profits.

Our empirical results indicate that intermediate-term, return-based strategies are profitable when the cross-sectional dispersion in unconditional mean returns dominates the component reflecting the intertemporal behaviour of asset returns. This suggests that higher (lower) returns of past winners (losers) in the holding period result from their higher (lower) unconditional expected returns, rather than from the delayed response in price or other intertemporal regularities caused by irrational investor behaviour. Our results support risk-based explanations for the momentum phenomenon rather than behavioural-based explanations, since the cross-sectional difference in unconditional expected returns is determined by the degree of riskiness. We therefore argue that the reason that the current existing asset pricing models fail to explain the momentum phenomenon may lie in the use of mis-specified asset pricing models in measuring abnormal returns.

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